

國立臺北科技大學 106 學年度碩士班招生考試

系所組別：1422 能源與冷凍空調工程系碩士班乙組

第二節 流體力學 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共五題，每題 20 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The viscosity of a fluid plays a very important role in determining how a fluid flows. The value of the viscosity depends not only on the specific fluid but also on the fluid temperature. Some experiments show that when a liquid, under the action of a constant driving pressure, is forced with a low velocity, V , through a small horizontal tube, the velocity is given by the equation $V = K/\mu$. In this equation K is a constant for a given tube and pressure, and μ is the dynamic viscosity. For a particular liquid of interest, the viscosity is given by Andrade's equation ($\mu = De^{B/T}$) with $D = 239 \times 10^{-7} \text{ N}\cdot\text{s}/\text{m}^2$ and $B = 2222\text{k}$. By what percentage will the velocity increase as the liquid temperature is increased from 4°C to 38°C (277 k to 311k)? Assume all other factors remain constant. (20分)
2. The velocity profile through the boundary layer at the downstream end of a flat plate is found to conform to the equation $v/V_0 = (y/\delta)^{1/8}$ in which V_0 is 6.1 m/s and δ is 0.3 m . Calculate the drag force exerted on (one side of) this plate if the fluid density is $1031 \text{ kg}/\text{m}^3$. (20分)
3. The discharge of oil from a tank through an orifice (as shown Fig.1) is to be modeled using water as the flowing fluid. The kinematic viscosity of the oil is 0.09 . What oil flowrate is represented by $0.0022\text{m}^3/\text{s}$ in the model? If the force exerted on the model tank bottom is 210N , what is the corresponding force in the prototype? (Note that the Reynolds and Froude similarity ought to hold for this flow dynamic similarity.) (20分)

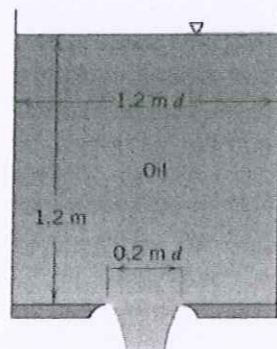


Fig. 1

4. Figure 2 shows that this ducted propeller system when moving forward at velocity V_1 will have an efficiency given by $2V_1/(V_4 + V_1)$. If for a specific design and point of operation, $V_2/V_1 = 9/4$ and $V_4/V_2 = 5/4$, what fraction of the propulsive force will be contributed: (a) by the propeller (10分), and (b) by the duct (10分)?

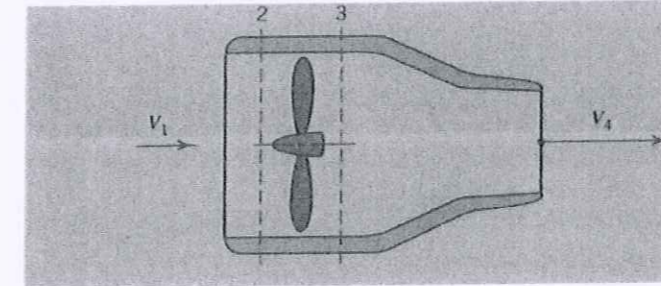


Fig. 2

5. The flowrate between tank A and tank B shown in Fig. 3 is to be increased by 30% (i.e. from Q to $1.30Q$) by the addition of a second pipe (indicated by dotted lines) running from node C to tank B. If the elevation of the free surface in tank A is 8m above that in tank B, determine the diameter, D , of this new pipe. Neglect minor losses and assume that the friction factor for each pipe is 0.02 . (20分)

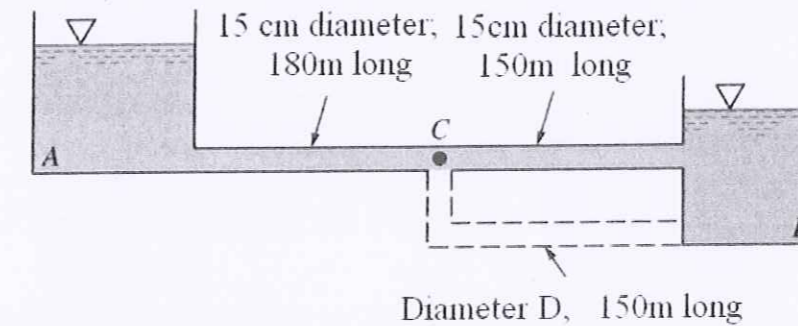


Fig. 3